WHAT IS CLAIMED IS:

1. An electric network simulating method comprising the steps of:

defining element cells representing electric functions of a plurality of circuit elements and connection pipes representing wiring lines for connecting the circuit elements, defining an electric network current as the number of particles moving in the connection pipe per unit time, and defining an electric network voltage as the number of particles present in the connection pipe;

on the basis of definitions in the defining step, setting beforehand, in units of element cells, a rule for expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to each of the element cells;

transferring particles between the element cell and the connection pipe in accordance with the set rule; and

simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time in the transferring step and the number of particles present in the given connection pipe, and performing transfer and updating processes at least once.

2. An electric network simulating method comprising the steps of:

after setting element cells representing electric functions of a plurality of circuit elements, intersection cells representing functions of electric wiring intersections, and connection pipes representing connections between the element cells and the intersection cells, defining a current of an electric network as the number of particles moving in the connection pipe per unit time, and defining a voltage of the electric network as the number of particles present in the connection pipe;

on the basis of the definitions in the defining step, setting beforehand, in units of element cells, a rule expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to the element cell, and setting beforehand, in units of intersection cells, a rule so that the numbers of particles present in the connection pipes connected to the intersection cell are equal to each other and a sum of the numbers of particles transferred at the intersection cell becomes zero;

transferring particles between the element cell and the connection pipe and between the intersection cell and the connection pipe on the basis of the rules set in the setting step; and

simulating the state of the electric network by updating the number of particles passing through a

given connection pipe per unit time and the number of particles present in the given connection pipe in the transferring step and performing transfer and updating processes at least once.

3. An electric network simulating method according to one of claims 1 and 2, wherein the setting step includes the step of

when a given one of the circuit elements is a current source, setting a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the given circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes.

4. An electric network simulating method according to one of claims 1 and 2, wherein the setting step includes the step of

when a given one of the circuit elements is a voltage source, setting a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the given circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

5. An electric network simulating method

according to one of claims 1 and 2, wherein the defining step includes the step of

when a given one of the element cells has nonlinearity as a function of time, defining the given circuit element as a combination of an element cell for a resistive element and one of an element cell expressing a current source and an element cell expressing a voltage source, the combination expresses linearity equivalent to a behavior of the given circuit element at given time; and

the setting step includes the steps of

when a certain one of the circuit elements is a current source, setting a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the certain circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes, and

when a specific one of the circuit elements is a voltage source, setting a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the specific circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

6. An electric network simulating method according to one of claims 1 and 2, wherein the setting step includes the step of

when a given one of the circuit elements has an impedance characteristic discontinuously changing, preparing a plurality of rules for the element cell for expressing the given circuit element and selecting one of the plurality of rules in accordance with the state of the connection pipe connected to the element cell.

7. An electric network simulating method according to claim 5, wherein the transferring step and the simulating step include the step of

simulating the state of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having nonlinearity as a function of time, simulating a behavior of the nonlinear element at an operating point advancing by a shortest time interval, by changing each parameter of a combination of the element cells having functions equivalent to the element cells, and simulating the transient phenomenon by repeating the change in parameter every time the shortest time interval has elapsed.

8. An electric network simulating method according to claim 6, wherein the transferring step and the simulating step include the step of

simulating a behavior of each element cell at

initial time so as to simulate a transient phenomenon of the given circuit element having the impedance characteristic discontinuously changing, simulating a behavior of the nonlinear element at an operating point advancing a shortest time interval by executing the transferring step in accordance with the rule selected in accordance with the state of the connection pipe connected to the element cell, and simulating the transient phenomenon by repeating the simulating steps every time the shortest time interval has elapsed.

9. An electric network simulating apparatus comprising:

means for defining element cells representing electric functions of a plurality of circuit elements and connection pipes representing wiring lines for connecting the circuit elements, defining an electric network current as the number of particles moving in the connection pipe per unit time, and defining an electric network voltage as the number of particles present in the connection pipe;

means for setting beforehand, on the basis of definitions in the defining means, in units of element cells, a rule for expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to each of the element cells;

means for transferring particles between the

element cell and the connection pipe in accordance with the set rule; and

means for simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time in the transferring means and the number of particles present in the given connection pipe, and performing the transfer means and updating process at least once.

10. An electric network simulating apparatus comprising:

means for, after setting element cells representing electric functions of a plurality of circuit elements, intersection cells representing functions of electric wiring intersections, and connection pipes representing connections between the element cells and the intersection cells, defining a current of an electric network as the number of particles moving in the connection pipe per unit time, and defining a voltage of the electric network as the number of particles present in the connection pipe;

means for setting beforehand, on the basis of the definitions in the defining means, in units of element cells, a rule expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to the element cell, and setting beforehand, in units of intersection cells, a rule so that the numbers of particles present in the

connection pipes connected to the intersection cell are equal to each other and a sum of the numbers of particles transferred at the intersection cell becomes zero;

means for transferring particles between the element cell and the connection pipe and between the intersection cell and the connection pipe on the basis of the rules set in the setting means; and

means for simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time and the number of particles present in the given connection pipe in the transferring means and performing transfer and updating processes at least once.

11. An electric network simulating apparatus according to one of claims 9 and 10, wherein the setting means includes

means for setting, when a given one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the given circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes.

12. An electric network simulating apparatus according to one of claims 9 and 10, wherein the

setting means includes

means for setting, when a given one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the given circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

13. An electric network simulating method according to one of claims 9 and 10, wherein the defining means includes

means for defining, when a given one of the element cells has nonlinearity as a function of time, the given circuit element as a combination of an element cell for a resistive element and one of an element cell expressing a current source and an element cell expressing a voltage source, the combination expresses linearity equivalent to a behavior of the given circuit element at given time; and

the setting means includes

means for setting, when a certain one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the certain circuit element and giving the number of

particles equal in number to the number of extracted particles to the other one of the two connection pipes, and

means for setting, when a specific one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the specific circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

14. An electric network simulating apparatus according to one of claims 9 and 10, wherein the setting means includes

means for, when a given one of the circuit elements has an impedance characteristic discontinuously changing, preparing a plurality of rules for the element cell for expressing the given circuit element and selecting one of the plurality of rules in accordance with the state of the connection pipe connected to the element cell.

15. An electric network simulating apparatus according to claim 13, wherein the transferring means and the simulating means include

means for simulating the state of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having

nonlinearity as a function of time, simulating a behavior of the nonlinear element at an operating point advancing by a shortest time interval, by changing each parameter of a combination of the element cells having functions equivalent to the element cells, and simulating the transient phenomenon by repeating the change in parameter every time the shortest time interval has elapsed.

16. An electric network simulating apparatus according to claim 14, wherein the transferring means and the simulating means include

means for simulating a behavior of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having the impedance characteristic discontinuously changing, simulating a behavior of the nonlinear element at an operating point advancing a shortest time interval by executing the transferring means in accordance with the rule selected in accordance with the state of the connection pipe connected to the element cell, and simulating the transient phenomenon by repeating the simulating means every time the shortest time interval has elapsed.

17. A storage medium storing a simulation program loaded and activated in a computer device, the program activating the computer device to generate:

means for defining element cells representing

electric functions of a plurality of circuit elements and connection pipes representing wiring lines for connecting the circuit elements, defining an electric network current as the number of particles moving in the connection pipe per unit time, and defining an electric network voltage as the number of particles present in the connection pipe;

means for setting beforehand, on the basis of definitions in the defining step, in units of element cells, a rule for expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to each of the element cells;

means for transferring particles between the element cell and the connection pipe in accordance with the set rule; and

means for simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time in the transferring step and the number of particles present in the given connection pipe, and performing the transfer means and updating process at least once.

18. A storage medium storing a simulation program loaded and activated in a computer device, the program activating the computer device to generate:

means for, after setting element cells representing electric functions of a plurality of circuit

elements, intersection cells representing functions of electric wiring intersections, and connection pipes representing connections between the element cells and the intersection cells, defining a current of an electric network as the number of particles moving in the connection pipe per unit time, and defining a voltage of the electric network as the number of particles present in the connection pipe;

means for setting beforehand, on the basis of the definitions in the defining step, in units of element cells, a rule expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to the element cell, and setting beforehand, in units of intersection cells, a rule so that the numbers of particles present in the connection pipes connected to the intersection cell are equal to each other and a sum of the numbers of particles transferred at the intersection cell becomes zero;

means for transferring particles between the element cell and the connection pipe and between the intersection cell and the connection pipe on the basis of the rules set in the setting step; and

means for simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time and the number of particles present in the given connection

pipe in the transferring means and performing transfer and updating processes at least once.

19. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the setting means includes

means for setting, when a given one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the given circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes.

20. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the setting means includes

means for setting, when a given one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the given circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

21. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the defining means includes

means for defining, when a given one of the element cells has nonlinearity as a function of time, the given circuit element as a combination of an element cell for a resistive element and one of an element cell expressing a current source and an element cell expressing a voltage source, the combination expresses linearity equivalent to a behavior of the given circuit element at given time; and

the setting means includes

means for setting, when a certain one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the certain circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes, and

means for setting, when a specific one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the specific circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

22. A storage medium storing the simulation

program according to one of claims 17 and 18, wherein the setting means includes

means for, when a given one of the circuit elements has an impedance characteristic discontinuously changing, preparing a plurality of rules for the element cell for expressing the given circuit element and selecting one of the plurality of rules in accordance with the state of the connection pipe connected to the element cell.

23. A storage medium storing the simulation program according to claim 22, wherein the transferring means and the simulating means include

means for simulating the state of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having nonlinearity as a function of time, simulating a behavior of the nonlinear element at an operating point advancing by a shortest time interval, by changing each parameter of a combination of the element cells having functions equivalent to the element cells, and simulating the transient phenomenon by repeating the change in parameter every time the shortest time interval has elapsed.

24. A storage medium storing the simulation program according to claim 23, wherein the transferring means and the simulating means include

means for simulating a behavior of each element

cell at initial time so as to simulate a transient phenomenon of the given circuit element having the impedance characteristic discontinuously changing, simulating a behavior of the nonlinear element at an operating point advancing a shortest time interval by executing the transferring step in accordance with the rule selected in accordance with the state of the connection pipe connected to the element cell, and simulating the transient phenomenon by repeating the simulating steps every time the shortest time interval has elapsed.